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MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

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SUBJECT: Science and Technology Priorities for the FY 2015 Budget

        Scientific discovery, technological breakthroughs, and innovation are the primary engines for expanding the frontiers of human knowledge and are vital for responding to the challenges and opportunities of the 21st century. We look to scientific innovation to promote sustainable economic growth and job creation, improve the health of all Americans, move us toward a clean energy future, address global climate change, manage competing demands on environmental resources, and ensure the security of the Nation. Science and engineering research is a valuable source of new knowledge that has driven important developments in fields ranging from telecommunications to medicine, yielding high economic and social rates of return and creating entirely new industries with highly-skilled, high-wage jobs.

        The Nation benefits from Federal government funding for basic and applied research in areas in which the private sector does not have the economic incentive to invest and a public benefit exists. This memorandum outlines the Administration's multi-agency science and technology priorities for formulating FY 2015 Budget submissions to the Office of Management and Budget (OMB). The priorities covered in this memo require investments in research and development (R&D); support for activities, such as STEM education, technology transfer, R&D facilities, and scientific data collection and management that enable a robust science and technology enterprise; and cooperation among multiple Federal agencies for success. They build on priorities reflected in this Administration's past budgets and documents, such as the President's *Strategy for American Innovation.*

Our budget challenges have only increased the President's resolve to work with Congress on restoring regular order and replacing sequestration with a balanced deficit reduction plan of additional spending cuts and sensible entitlement reforms coupled with revenue from tax reform. The FY 2014 Budget included such a balanced approach, with more than enough deficit reduction to cancel sequestration and restore discretionary funding to levels agreed to in the bipartisan Budget Control Act. The FY 2015 Budget should continue to build on the President's plan, by reducing spending on lower-priority programs in order to create room for effective investments in areas critical to economic growth and job creation, including education, innovation, and research and development.

More effective management strategies will be an important component of our overall approach to research and development budgeting. We look forward to working closely with the agencies to make the hard decisions that are necessary to reduce the deficit while investing in critical priorities, including research and development. Agencies engaged in complementary activities should consult with each other during the budget planning process so that resources are coordinated to maximize their impact and to avoid inappropriate duplication. They should also avoid duplicating research in areas that already receive funding from the private sector. Agencies should explain in their budget submissions how they are redirecting available resources from lower-priority areas to science and technology activities that address the priorities described below. Agency submissions must meet the requirements outlined in OMB's FY 2015 Budget Guidance memorandum M-13-14.

Within research portfolios, Federal agencies are encouraged to identify and pursue clearly defined "Grand Challenges" – ambitious goals that require advances in science, technology and innovation to achieve, and to support high-risk, high-return research.

Agencies should consider increased international scientific cooperation and partnerships to address areas of mutual interest, to advance the Administration's priorities in global health and global development, and to share the financial burden of large research projects.

Agencies should also support the research tools and infrastructure needed to ensure that U.S. science and engineering remain at the leading edge of discovery. Proposals for major new facilities must be consistent with Federal real property guidance and development, construction, and operations costs must be fully justified and balanced against funding for research activities and operations of existing facilities. Tools and infrastructure investments that leverage funding from multiple agencies or promote the sharing of costs and resources between public and private sector organization should be prioritized.

The Administration is committed to increasing public access to the results of federally funded scientific research including data and publications that describe research findings. Consistent with the Executive Order on *Making Open and Machine Readable the New Default for Government Information* and the OSTP-issued *Memorandum on Increasing Access to the Results of Federally Funded Scientific Research*, agencies should give priority to activities that significantly increase access to research results for all citizens.

Program guidance

In accordance with OMB Circular A-11 and the GPRA Modernization Act of 2010, agencies should describe the targeted outcomes of research and development (R&D) programs using meaningful, measurable, quantitative metrics where possible and describe how they plan to evaluate the success of those programs.

Multi-agency priorities

The Administration recognizes that agency-specific research needed to make progress toward agency missions is important. In the FY 2015 Budget, agencies should balance priorities to ensure resources are adequately allocated for agency-specific, mission-driven research while focusing resources, where appropriate, on addressing the following multi-agency research activities that cannot be addressed effectively by a single agency.

Advanced manufacturing

The Administration is committed to revitalizing and transforming America's manufacturing sector. Agencies should give priority to those programs that advance the state of the art in manufacturing, with particular emphasis on government-industry-university partnerships and enabling technologies (such as robotics, materials development, and cyber-physical systems) that benefit multiple sectors, as described in the *National Strategic Plan for Advanced Manufacturing*. Sustained support for nanotechnology R&D, particularly the five Nanotechnology Signature Initiatives in nanomanufacturing, solar energy, nanoelectronics, sensors, and nanoinformatics and modeling, is also important to the success of the Administration's advanced manufacturing agenda.

Clean energy

The Administration intends for the United States to lead the world in clean-energy technology R&D to help reduce air pollution, greenhouse-gas emissions, and dependence on oil, while creating high-wage, highly-skilled, clean-energy jobs and businesses. Agencies should give priority to R&D to advance clean-energy technologies; to improve the efficiency, sustainability, and cost-effectiveness of transportation alternatives; to address the manufacturing challenges of clean-energy supply technologies; to increase energy efficiency in industry, buildings, and manufacturing; and for the next-generation electric grid.

Global climate change

Within the U.S. Global Change Research Program, agencies should continue to make progress toward fulfilling the 2012-2021 Strategic Plan. FY 2015 priority areas include better understanding of the causes and consequences of drought and the interaction of global-change impacts in the Arctic with climate in the mid-latitudes. Emphasis should also be given to research that enhances predictions of climate-related interactions among physical-biological-human systems on seasonal to multi-decadal timescales. In improving the nation's ability to understand, assess and respond to climate-related risks and opportunities, agencies should

prioritize activities that strengthen the scientific basis for decisions about both mitigation of and adaptation to climate change and that enhance utility of data and tools for purposes such as catastrophe risk management in a non-stationary climate.

R&D for informed policy-making and management

Agencies, especially those with primary missions other than R&D, should give priority to R&D that strengthens the scientific basis for decision-making in their mission areas, including but not limited to health, safety, and environmental impacts. This includes efforts to enhance the accessibility and usefulness of data and tools for decision support, as well as research in the social and behavioral sciences to support evidence-based policy and effective policy implementation. Further, to help the Nation become more resilient to natural and technological disasters, agencies should focus investments on improving the delivery of hazard information where and when it is needed, enhancing the understanding of the natural processes that produce hazards, developing better hazard mitigation strategies and technologies, reducing the vulnerability of interdependent critical infrastructure, improving assessments of disaster resilience, and promoting risk-informed behavior.

Information Technology

Agencies should give priority to investments that address the challenges of, and tap the opportunities afforded by, the Big Data revolution – the fast-growing volume of large and complex collections of digital data – to advance agency missions and further scientific discovery and innovation while providing appropriate privacy protections for personal data. Agencies should also prioritize research guided by the *Trustworthy Cyberspace: Strategic Plan for Cybersecurity R&D Programs* to develop technologies that can protect U.S. systems against current and future cyber-attacks, as well as research to advance technologies for spectrum sharing and more efficient use of spectrum.

R&D for National-Security Missions

National and Homeland Security and Intelligence mission agencies should invest in science and technology to meet the threats of the future and develop innovative new security capabilities. In order to provide cutting-edge capabilities to meet current and future mission requirements, national security agencies need to support a balanced portfolio of basic and applied research and advanced technology development. In particular, priority should be given to investments to develop capabilities in hypersonics, countering weapons of mass destruction, advanced computing, accelerated training, and handling large data sets for national-security mission requirements.

Innovation in Biology and Neuroscience

Agencies should give priority to R&D investments that have the potential to foster biological innovations in health, national security, energy, and agriculture, particularly in platform technologies as described in the Administration's 2012 *National Bioeconomy Blueprint* (e.g. technologies for the design of biological systems, understanding systems biology, and high-

throughput biology), science and technology to support the goals of the *National Strategy for Biosurveillance*, and research at the interfaces of biology, physical sciences, and engineering. Agencies should also give priority to the President's BRAIN (Basic Research through Advancing Innovative Neurotechnologies) Initiative, and other priorities identified by the NSTC Interagency Working Group on Neuroscience, including the relationship between the brain and behavior, cognition, development, and learning.

Science, technology, engineering, and mathematics (STEM) education

The President is committed to improving STEM education and to ensuring that Federal resources are aligned and directed to improve STEM outcomes and prepare a strong STEM-capable workforce. To support these goals, the Administration has proposed a bold STEM education reorganization and a comprehensive 5-Year Strategic Plan. As agencies develop 2015 Budget proposals, they should align their STEM education investments with the goals of the reorganization and the Strategic Plan. This includes giving priority to programs that use evidence to guide program design and implementation and to define appropriate metrics and improve the measurement of outcomes. Agencies should also ensure that programs are designed to identify and effectively meet the needs of end-users – students, teachers, schools, districts and post-secondary institutions – while continuing to reduce STEM-education program fragmentation.

In particular, agencies should consider building capacity and infrastructure to support and advance the reorganization and Strategic Plan goals. Agencies should improve coordination with other agencies and focus funding on priority STEM-education investment areas as identified in the Strategic Plan, including: improving STEM instruction and learning; increasing and sustaining youth and public engagement in STEM; enhancing the STEM experience of undergraduate students; providing STEM learning opportunities to groups historically underrepresented in STEM fields; and designing graduate education for tomorrow's STEM workforce. Agencies with a strong capacity to conduct rigorous evaluations and to build evidence should also give priority to R&D investments in the science and technology of learning with the potential to significantly improve student learning outcomes in STEM subjects, such as digital tutors, learning analytics, simulations, games, and embedded assessment.

Innovation and commercialization

Agencies should promote innovation and commercialization from Federal R&D investments, where appropriate, through support for inducement prizes, fostering the transition of emerging scientific discoveries into engineering disciplines, early-stage technology development, university-industry-government-laboratory partnerships, leveraging of focused and coordinated investments in the Small Business Innovation Research (SBIR) program, and efforts to better link graduate and postdoctoral training with both private and public-sector workforce needs. Such efforts should be aligned with the Administration's Cross-Agency Priority Goal to improve performance across Federal services for entrepreneurs and small businesses.